03500.015727. PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	:	Examiner: D. H. Vu
TAKEO TSUKAMOTO	)	
	:	Group Art Unit: 2879
Application No.: 09/941,780	)	
	:	
Filed: August 30, 2001	)	
	:	
For: ELECTRON-EMITTING DEVICE, ELECTRON-EMITTING APPARATUS, IMAGE DISPLAY APPARATUS, AND LIGHT-EMITTING APPARATUS	)	April 25, 2006

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Sir:

In compliance with the duty of disclosure under 37 C.F.R. § 1.56 and in accordance with the practice under 37 C.F.R. §§ 1.97 and 1.98, the Examiner's attention is directed to the documents listed on the enclosed Form PTO-1449. Copies of the non-U.S. patent documents listed on Form PTO-1449 and a copy of a Japanese Official Letter citing some of these documents are enclosed. The Japanese Official Letter was issued in a foreign counterpart application.

Japanese Patent Application Publication Nos. 09-237565 and 2001-288625 (corresponding to Japanese Patent Appln. No. 2001-4550), which are cited in the Japanese Official Letter, are not listed on the Form PTO-1449, because these documents are already of record.

With respect to documents (1) - (5) cited in the Japanese Official Letter, the Letter states the following:

With regard to claims 1 and 2, document 1 is relevant.

Document 1 discloses an electron emission from a carbon nono fiber wherein graphite sheets are laminated in non-parallel to an axis thereof, and most of a surface thereof is formed from an end plane of the graphite sheets (see pp.3105-3106 and Fig. 2). Accordingly, it is obvious to use the above structure as an emitter of a well known electron emission apparatus provided with a cathode electrode, a control electrode and an anode electrode.

With regard to claims 3-12, documents 1 and 2 are relevant.

It is well known as shown in document 2 that a cathode electrode and a control electrode are separately disposed on a common substrate.

And, the document 2 discloses also that the cathode electrode is positioned above the control electrode and at a side of the anode electrode. (see paragraph (0068) and Fig.11)

It would be obvious to use the above structure to the electron source and the image display apparatus.

With regard to claims 1-3, 5-12, prior application documents 3-5 are relevant.

All of the documents 3-5 disclose in the specification and the drawings an electron-emitting device provided with a graphite nano fiber wherein graphens are laminated in non-parallel to an axis thereof.

And, the electron-emitting device wherein a cathode electrode and a control electrode are disposed on a surface of a common substrate, an electron emitting apparatus comprising such devices, an electron source and an image forming apparatus are well known as shown in the document 2. Accordingly, the claims 1-3 and 5-12 are the same as the invention disclosed in the prior application documents 3-5.

Applicant also represents that document JP 09-237565, cited in the Japanese Official Letter, states the following in paragraphs (0063) - (0071):

(0063) (Embodiment 2) Figs. 9-11 show a process for producing a lateral type electron-emitting device according to the present invention. On a quartz substrate (insulating substrate) 91 of a thickness 1mm, a Si layer 92 of a thickness 1 micron is bonded. According to CVD method under the same condition as in a table 2, silicon carbide film 93 of a thickness 1 micron is formed (Fig. 9 (a)). In producing the silicon carbide film 93, as a doping gas, NH3 of 0.5sccm is used. As a result, N is added at 70ppm.

(0064) On the silicon carbide film 93, a resist film of a thickness 3 micron is formed. By lithography process, a wedge shaped resist 94 is formed by exposure and development through a wedge shaped mask. (Fig.9(b))

(0065) Next, using the wedge shaped resist as a mask, the Si layer 92 and the silicon carbide 93 are removed from a part which is not masked by the RIE under the condition at a table 7, to expose the quartz substrate surface 91a. (Fig. 9(c))

(0066) next, the exposed surface 91a of the quartz of the insulating substrate 91 is dipped through a mask of a resist 94 into HF 5% solution for etching into a depth 1micron to expose new quartz substrate surface 91b. (Fig. 9(d))

(0067) By a sputter process, a tungsten of a thickness 1 micron (95 a and b) is deposited (Fig. 10 (e)). Thereafter, by developed by a development liquid of the resist, the resist 94 on the silicon carbide film 93 and the tungsten 95b thereon are removed. (Fig. 10f)

(0068) Using as a mask the tungsten 95a on the quartz 91b as being a gate, and the silicon carbide 93 as being the emitter, the quartz therebetween is removed by etching to form a groove (gap). Thus, a lateral type field electron emission device wherein the emitter 93 and the gate 95a are formed through the groove is formed. (Fig. 11)

(0069) In the field electron emission emitter of the Second Embodiment, a protrusion end (emitter) at which the electric field is collected is formed from a single silicon carbide having excellent thermal durability. Accordingly, a sufficient thermal durability and stability against Joule can be maintained. And, the surface of the emitter formed from the silicon carbide has a sufficient resistance against oxidization and the etching, and a sufficient mechanical strength. Accordingly, an emission current would be made stable for a long time.

(0070) N (donor impurity) of 70ppm is added to the silicon carbide forming the emitter. Accordingly, the silicon carbide is degenerated so that a surface electron affinity is lower than 3eV. And, a voltage applied to the gate electrode is reduced into several 10-100 V.

(0071) In the emitter of the Embodiment 2, an impurity of 70ppm is added. An impurity level is formed in a conduction band of the silicon carbide. Accordingly, an electron excitement between the impurity and the band is suppressed. The emission current from the emitter is not varied due to heat light, crystalline lattice direction, and crystalline configuration. Further, since, rather than an energy band gap (1.12eV) of silicon, an energy band gap (2.2-2.8eV) of the silicon carbide is larger, the electron emitting device can be stably operated even at a high temperature such as higher than 500 centigrade.

Applicant also represents that document JP 2001-288625, cited in the Japanese Official Letter, states the following in paragraph (0015):

A lithium ion secondary battery according to the present invention is a secondary battery comprising a positive electrode of positive electrode active material formed from lithium transition metal oxide, a negative electrode of a negative electrode active material formed from carbon material and an electrolyte liquid of an organic solvent, wherein the carbon material is formed from a graphite nano fiber of the above described structure. Using such carbon material, a cycle life time is made longer. And, a lithium ion secondary battery of high speed charging and large capacity of the discharging can be provided.

As a further concise statement of relevance of documents JP 09-237565 and JP 2001-288625, the Examiner is referred to the English Abstracts attached hereto.

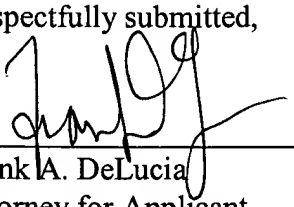
For the concise statement of relevance of non-English document JPA 2000-207983, the Examiner is respectfully referred to the English abstract attached thereto.

For the concise statement of relevance of non-English document JPA 2002-500415, the Examiner is respectfully referred to English language counterpart WO 01/93292 A1 attached thereto.

It is respectfully requested that the above information be considered by the Examiner and that an initialed copy of the enclosed Form PTO-1449 be returned indicating that such information has been considered.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address given below.

Respectfully submitted,



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FORM PTO 1449 (*modified*)

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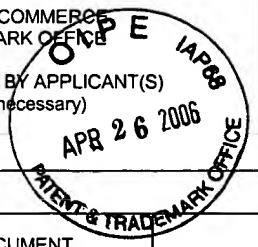
LIST OF REFERENCES CITED BY APPLICANT(S)
(Use several sheets if necessary)



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APPLICANT: TAKEO TSUKAMOTO

FILING DATE	GROUP
August 30, 2001	2828

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		2003/0048057 A1	3/13/03	Oyama et al.	313	311	
		2002/0031972 A1	3/14/02	Kitamura et al.	445	3	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES/NO/ OR ABSTRACT
	JP	2000-207983	07/28/00	Japan			Abstract
	JP	2002-500415	01/08/02	Japan			No
	WO	01/93292 A1	12/6/01	PCT			English

OTHER DOCUMENT(S) (Including Author, Title, Date, Pertinent Pages, Etc.)

		Xucun Ma et al., Polymerized carbon nanobells and their field-emission properties, Applied Physics Letters, 15 Nov. 1999, Vol. 75, No. 20, pp. 3105-3107.

EXAMINER	DATE CONSIDERED

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy o this form with next communication to applicant.

Form #62